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Efficacy of Suprachoroidal Triamcinolone Acetonide Injections in Resistant Diabetic Macular Edema

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ABSTRACT

Localized drug delivery through the suprachoroidal space can be used for more targeted therapies whilst minimize exposure to the healthy tissues. **Objectives:** To determine the efficacy of suprachoroidal triamcinolone injection given by the suprachoroidal route in patients with resistant diabetic macular edema. **Methods:** A quasi-experimental study was done at Al Ibrahim Eye Hospital, Karachi's Vitreo-retina Department. Duration of research was 6 months (July to December 2024)(ATMC/ERC/13(01/2023/22). Adult patients attending the vitreo-retinal OPD with resistant diabetic macular edema were included. Data were analyzed using SPSS version 22.0. Discrete variables were reported as mean and standard deviation, and continuous variables as frequencies and percentages. BCVA and CST readings at 4, 8 and 12 weeks were compared with baseline using a paired t-test, with p-value <0.05 statistically significant. **Results:** Before injection. The pre- and post SCTA BCVA and CST with baseline mean BCVA were 1.1 ± 0.30, which progressively improved at subsequent follow-ups, reaching 0.33 ± 0.18 by the third month post-injection. **Conclusions:** SCTA injections significantly improve visual acuity and reduce central subfield thickness in patients over a three-month follow-up period. The progressive enhancement in Best Corrected Visual Acuity and consistent reduction in Central Subfield Thickness highlight the efficacy of SCTA.

INTRODUCTION

Treating diabetic macular edema involves localized or systemic immune-modulatory drugs. Localized therapies rely on corticosteroids, which are administered as topical eye drops, peri-ocular injections, intraocular or as an implant technology [1]. Using anti-VEGF (vascular endothelial growth factors) is less common because of limited efficacy and the requirement of multiple and frequent administrations as opposed to corticosteroids [2]. There are multiple ways for administering corticosteroids in the eye. Diffusion from peri-ocular sites, direct injection into the vitreous or re-distribution via the vascular system after systemic absorption [3]. Nonetheless, some adverse events are linked with such local treatments as glaucoma and cataract [4]. The challenging task to achieve drug localization effectively when systematically administered underscores the requirement for improved local treatments having better safety profiles in the management of non-infectious uveitis, leading to secondary macular edema [5]. The space in between the sclera and the choroid, known as the

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suprachoroidal space, is vital to maintain the intraocular pressure via uveoscleral outflow [6]. Under normal circumstances, the space remains collapsed; however, it can expand and so be used as a drug delivery system for targeted therapy since it is in close approximation to choroid, retina and retinal pigment epithelium [7]. Normally, this space is accessed during surgical procedures such as for drug delivery or sclerotomy, but poses a challenge for safe and consistent procedure performance [8]. Therefore, the intravitreal injection is the most common drug delivery method used [9]. Presently, micro-needles are increasingly being used for drug administration via the suprachoroidal space. Right after injecting, the drug tends to disperse around the eye, which allows gradual diffusion to the retina and retinal pigment epithelium [10]. Research has demonstrated the use of suprachoroidal space injections for administering high concentrations of drugs into the chorioretinal tissues [11]. In addition, faster clearance is observed in comparison to intra-vitreal injection when used in animals [12]. Results show triamcinolone acetonide in rabbits caused minimal drug expansion into the anterior segment and lens, only remaining confined to the choroid and retina [13]. Researchers suggest that drug delivery localization to the suprachoroidal space can be used for more targeted therapies whilst minimize exposure to the healthy tissues. Further studies are required to confirm the amount of drug required to maintain desired drug efficacy for as much as three months, highlighting the potential for the treatment of retinal or choroid diseases effectively [14].

This study aims to determine the efficacy of suprachoroidal triamcinolone injection given by the suprachoroidal route in patients with resistant diabetic macular edema.

METHODS

This interventional quasi-experimental research was done at the Department of Vitreo-Retina of Al Ibrahim Eye Hospital, part of the ISRA University in Karachi (Ethical approval number- ATMC/ERC/13 (01/2023/22). The study spanned six months (July to December 2024), utilizing a consecutive sampling. The calculation of sample size was done by the Open Epi online tool, assuming a baseline BCVA and 80% power. A total of 45 patients were included in the study. Keeping the frequency of macular edema at 7% as reported in literature, at a 95% confidence level and 5 % margin of error, the sample size came out to be 101%. This research included adults visiting vitreo-retinal OPD who had resistant diabetic macular edema, despite having received three intra-vitreal anti-VEGF injections at one-month intervals. Exclusion criteria were set for patients with an IOP >20 mmHg, macular ischemia (as confirmed by fluorescein angiography), cataract, renal disease or ocular hypertension. Additionally, patients who had received posterior sub-Tenon triamcinolone acetonide or intravitreal triamcinolone injections within the last three months were also excluded. Informed consent was taken was each patient. Resistant diabetic macular edema was defined as macular edema in diabetic patients that did not respond effectively to a loading dose of three anti-VEGF injections given one month apart. No improvement in CMT (measured with OCT) or BCVA (measured using the Snellen chart) was considered a lack of improvement. Eligible participants were given an SCTA injection. Using an applanation tonometer, measurement of IOP at pre-injection was done. The injection process involved using a 1 cc insulin syringe using a 30-gauge needle. Triamcinolone acetonide (TA) was injected at 40 mg/ml (Kenakort A). The injection was administered via a 24-gauge IV catheter. After all aseptic measures, 0.1 ml of TA (equivalent to 4 mg) was injected into the supra-choroidal space, 3.5 mm from limbus, in either the infra-temporal or supra-temporal region. The needle was gradually withdrawn, and a cotton-tip applicator was applied to minimize reflux at the injection site. Moxifloxacin eye drops were applied to the cornea following the procedure. Patients were closely monitored for three months, with follow-up visits scheduled at 4, 8, and 12 weeks. BCVA and CST were measured and documented at each follow-up visit. Using SPSS version 22.0 for data analysis, discrete variables were tabulated as mean and standard deviation, while continuous as frequencies (%). Paired t-test was applied to test between pre-operative BCVA and CST and post-operative injections at one, two and three months, with a p-value of <0.05 statistically significant.

RESULTS

The pre- and post-SCTA BCVA and CST with baseline mean BCVA were 1.1 ± 0.30, which progressively improved at subsequent follow-ups, reaching 0.33 ± 0.18 by the third month post-injection. Similarly, the Central Subfield Thickness (CST) showed significant reductions from a pre-injection mean of 638.78 ± 242.62 µm to 309.65 ± 80.14 µm at the third-month follow-up. These findings suggest marked improvements in both BCVA and CST over the observation period (Table 1).

Table 1: Pre and Post-SCTA BCVA and CST in Patients Included in the Study (n=45)

Injection Durations	Mean ± SD	
	Best Corrected Visual Acuity (95 % CI)	Central Subfield Thickness (um) (95 % CI)
Pre-Injection	1.1 ± 0.30 (0.99-1.21)	638.78 ± 242.62 (548.18-729.38)
One Month	0.7 ± 0.21 (0.62-0.78)	463.29 ± 168.22 (400.48-526.10)
Two Months	0.49 ± 0.19 (0.42-0.56)	395.88 ± 122.61 (350.10-441.66)
Three Months	0.33 ± 0.18 (0.26-0.40)	309.65 ± 80.14 (279.73-339.57)

The mean difference between BCVA and CST at Various

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Time Frames Pre- and Post-operatively are analyzed. There were statistically significant improvements in BCVA and CST at all post-injection time points compared to the baseline. Mean BCVA improved consistently from 1.1 ± 0.30 to 0.7 ± 0.21 at one month, 0.49 ± 0.19 at two months, and 0.33 ± 0.18 at three months ($p<0.001$). Correspondingly, the mean CST decreased from 638.78 ± 242.62 µm pre-operatively to 463.29 ± 168.22 µm, 395.88 ± 122.61 um, and 309.65 ± 80.14 um at one, two, and three months, respectively ($p<0.001$). These results confirm sustained structural and functional improvements (Table 2).

Table 2: Mean Difference between BCVA and CST at Various Time Frames Pre and Post-Operatively (n=45)

Duration of Injection	Pre-operative	Pre-operative vs. One Month	Pre-operative vs. Two Months	Pre-operative vs. Three Months	p-Value
Best Corrected Visual Acuity	1.1 ± 0.30 (0.99-1.21)	0.7 ± 0.21 (0.62-0.78)	0.49 ± 0.19 (0.42-0.56)	0.33 ± 0.18 (0.26-0.40)	<0.001
Central Subfield Thickness (um)	638.78 ± 242.62 (548.18-729.38)	463.29 ± 168.22 (400.48-526.10)	395.88 ± 122.61 (350.10-441.66)	309.65 ± 80.14 (279.73-339.57)	<0.001

The progressive improvement in BCVA following SCTA injection is depicted. The trend indicates significant functional recovery, with the most notable improvement observed between the second and third months (Figure 1).

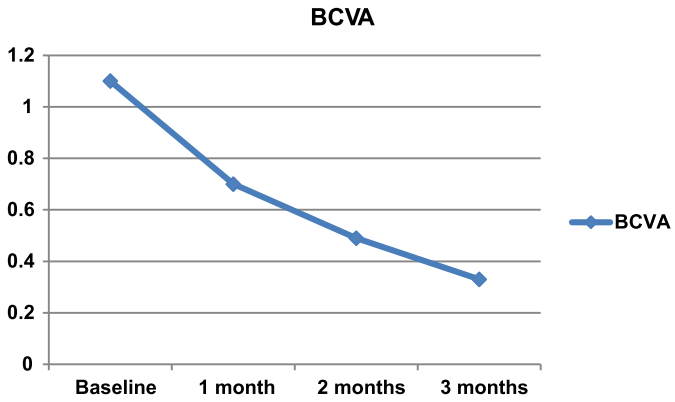

Figure 1: Graphical Representation of BCVA at Baseline, One Month, Two Months and Three Months Post SCTA Injection

The CST reduction across the observation periods is observed. The marked decline in CST reflects effective control of edema, with the most substantial changes occurring within the first two months' post-injection (Figure 2).

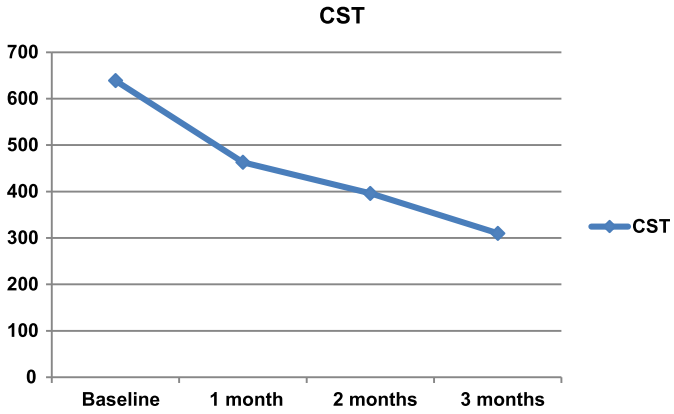

Figure 2: Graphical Representation of CST at Baseline, One Month, Two Months and Three-Month Post SCTA Injection

DISCUSSION

This study demonstrated that suprachoroidal injection of triamcinolone acetonide was safely evaluated for its effects on BCVA and CST over both short-term and long-term periods. Similarly, published literature has also reported findings in line with our study [15-17]. Immediately post-suprachoroidal triamcinolone acetonide injection (SCTA), a decrease in both BCVA and CST was observed. Likewise, another study by Jamil et al reported that the mean change in CST after a month of SCTA was 593.62 ± 116.87 µm (baseline) and 303.55 ± 31.29 µm, respectively ($p<0.001$). Similarly, BCVA before and after one month was significantly lower, i.e. 0.81 ± 0.16 and 0.45 ± 0.03, respectively ($p<0.001$). The study concluded that SCTA is useful in the management of CST and BCVA [18]. Similar to the findings of our study, another study by Nawar, reported that CST reduced significantly from 478.7 ± 170.2 µm pre-injection to 230.2 ± 47 µm 12 months after SCTA ($p<0.001$). BCVA improved from 1.193 ± 0.2 to 0.76 ± 0.3 after 12 months of SCTA ($p<0.001$) [19]. Akhlaq et al., in yet another research carried out to determine the efficacy of SCTA in patients of refractory diabetic macular edema reported it to be a safe and effective treatment modality as it decreased CST and improved BCVA [20]. However, research has reported that the risk of significant IOP, CST and BCVA elevation can be substantial in patients receiving suprachoroidal triamcinolone acetonide, especially in those with pre-existing risk factors such as a history of glaucoma or steroid-induced elevation. The timing of this elevation can vary, but it is generally observed within the first few months after injection [21]. Overall, the evidence suggests that while there is a notable short-term increase in IOP following suprachoroidal triamcinolone acetonide injection, this effect is generally transient, with IOP stabilizing back to baseline levels within a few months. This pattern highlights the importance of monitoring IOP in patients receiving this treatment, particularly in the short term.

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CONCLUSIONS

The study findings demonstrate that SCTA injections significantly improve visual acuity and reduce CST over a three-month follow-up period. The progressive enhancement in BCVA and consistent reduction in CST highlight the efficacy of SCTA as a therapeutic intervention for the management of retinal conditions associated with edema. More studies are recommended to evaluate long-term outcomes and optimize treatment protocols.

Authors Contribution

Conceptualization: VK
Methodology: VK, UH
Formal analysis: VK
Writing review and editing: NAM, UK, SHS, AQ

All authors have read and agreed to the published version of the manuscript

Conflicts of Interest

All the authors declare no conflict of interest.

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REFERENCES

[1] Gamalero L, Simonini G, Ferrara G, Polizzi S, Giani T, Cimaz R. Evidence-based treatment for uveitis. Israel Journal of Medical Sciences. 2019 Jul; 21(7): 475-9.

[2] Kawali AA, Mohan A, Mehta R, Mahendradas P, Srinivasan S, Shetty B. Anti-vascular endothelial growth factor in the treatment of macular edema in epidemic retinitis. Indian Journal of Ophthalmology. 2020 Sep; 68(9): 1912-5. doi: 10.4103/ijo.IJO_439_20.

[3] Lee JY, Lee SY, Kim JY, Lee HJ, Jeong JH, Ma DJ. Effect of alternate treatment with intravitreal anti-vascular endothelial growth factor and steroid for treatment-naive diabetic macular edema in a real-life setting. Journal of Ocular Pharmacology and Therapeutics. 2020 Sep; 36(7): 555-62. doi: 10.1089/jop.2020.0012.

[4] Han JV, Patel DV, Squirrell D, McGhee CN. Cystoid macular oedema following cataract surgery: a review. Clinical and Experimental Ophthalmology. 2019 Apr; 47(3): 346-56. doi: 10.1111/ceo.13513.

[5] Massa H, Pipis SY, Adewoyin T, Vergados A, Patra S, Panos GD. Macular edema associated with non-infectious uveitis: pathophysiology, etiology, prevalence, impact and management challenges. Clinical Ophthalmology. 2019 Sep: 1761-77. doi: 10.2147/OPTH.S180580.

[6] Saidkasimova S. Anatomy and physiology of the suprachoroidal space. Suprachoroidal Space Interventions. 2021: 1-30. doi: 10.1007/978-3-030-76853-9_1.

[7] Shah SS, Haseeb U, Ahmed N, Ahmed I, Ahmed S, Shah SH. Effect of Supra Choroid Triamcinolone Acetate On Intraocular Pressure: Supra Choroid Triamcinolone Acetate for Intraocular Pressure. Pakistan Journal of Health Sciences. 2025 Jan: 152-6. doi: 10.54393/pjhs.v6i1.2087.

[8] Jung JH, Chae JJ, Prausnitz MR. Targeting drug delivery within the suprachoroidal space. Drug Discovery Today. 2019 Aug;24(8): 1654-9. doi: 10.1016/j.drudis.2019.03.027.

[9] Naftali Ben Haim L, Moisseiev E. Drug delivery via the suprachoroidal space for the treatment of retinal diseases. Pharmaceutics. 2021 Jun; 13(7): 967. doi: 10.3390/pharmaceutics13070967.

[10] Ciulla T and Yeh S. Microinjection via the suprachoroidal space: a review of a novel mode of administration. American Journal of Managed Care. 2022 Nov; 28. doi: 10.37765/ajmc.2022.89270.

[11] Wykoff CC, Avery RL, Barakat MR, Boyer DS, Brown DM, Brucker AJ *et al.* Suprachoroidal Space Injection Technique: Expert Panel Guidance. Retina. 2022 May: 10-97.

[12] Habot-Wilner Z, Noronha G, Wykoff CC. Suprachoroidally injected pharmacological agents for the treatment of chorio-retinal diseases: a targeted approach. Acta Ophthalmologica. 2019 Aug; 97(5): 460-72. doi: 10.1111/aos.14042.

[13] Muya L, Kansara V, Cavet ME, Ciulla T. Suprachoroidal injection of triamcinolone acetonide suspension: ocular pharmacokinetics and distribution in rabbits demonstrates high and durable levels in the chorioretina. Journal of Ocular Pharmacology and Therapeutics. 2022 Aug; 38(6): 459-67.

[14] Wu KY, Fujioka JK, Gholamian T, Zaharia M, Tran SD. Suprachoroidal injection: a novel approach for targeted drug delivery. Pharmaceuticals. 2023 Sep; 16(9): 1241. doi: 10.3390/ph16091241.

[15] Hanif J, Iqbal K, Perveen F, Arif A, Iqbal RN, Jameel F *et al.* Safety and efficacy of suprachoroidal injection of triamcinolone in treating macular edema secondary to noninfectious uveitis. Cureus. 2021 Nov; 13(11). doi: 10.7759/cureus.20038.

[16] Thomas J, Kim L, Albini T, Yeh S. Triamcinolone acetonide injectable suspension for suprachoroidal use in the treatment of macular edema associated with uveitis. Expert Review of Ophthalmology. 2022 May; 17(3): 165-73. doi: 10.1080/17469899.2022.2114456.

[17] Abdelshafy Tabl A, Tawfik Soliman T, Anany Elsayed M, Abdelshafy Tabl M. A randomized trial comparing suprachoroidal and intravitreal injection of triamcinolone acetonide in refractory diabetic

DOI: https://doi.org/10.54393/pjhs.v6i5.2966

macular edema due to epiretinal membrane. Journal of Ophthalmology. 2022; 2022(1): 7947710. doi: 10.1155/2022/7947710.

[18] Jamil MH, Ashraf A, Khan A, Ashraf B, Afzal MB, Shahbaz F. Outcome of Suprachoroidal Triamcinolone Acetonide in Resistant Diabetic Macular Edema: Resistant Diabetic Macular Edema. Pakistan Journal of Health Sciences. 2023 Jul: 74-8. doi: 10.54393/pjhs.v4i07.932.

[19] Nawar AE. Effectiveness of suprachoroidal injection of triamcinolone acetonide in resistant diabetic macular edema using a modified microneedle. Clinical Ophthalmology (Auckland, NZ). 2022 Nov; 16: 3821. doi: 10.2147/OPTH.S391319.

[20] Akhlaq HH, Shah FA, Ahsen M, Hassan SA, Zahid K, Wattoo RR. Efficacy and Safety of Suprachoroidal Administration of Triamcinolone Acetonide in Patients of Refractory Diabetic Macular Edema. Pakistan Journal of Medical and Health Sciences. 2022; 16(11): 592-. doi: 10.53350/pjmhs20221611592.

[21] Bhattacharyya S, Hariprasad SM, Albini TA, Dutta SK, John D, Padula WV *et al.* Suprachoroidal injection of triamcinolone acetonide injectable suspension for the treatment of macular edema associated with uveitis in the United States: a cost-effectiveness analysis. Value in Health. 2022 Oct; 25(10): 1705-16. doi: 10.1016/j.jval.2022.07.008.